

High Vin SC Converters and Supporting Circuits for Power on Chip Applications

PwrSoC 2016, Madrid

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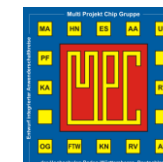


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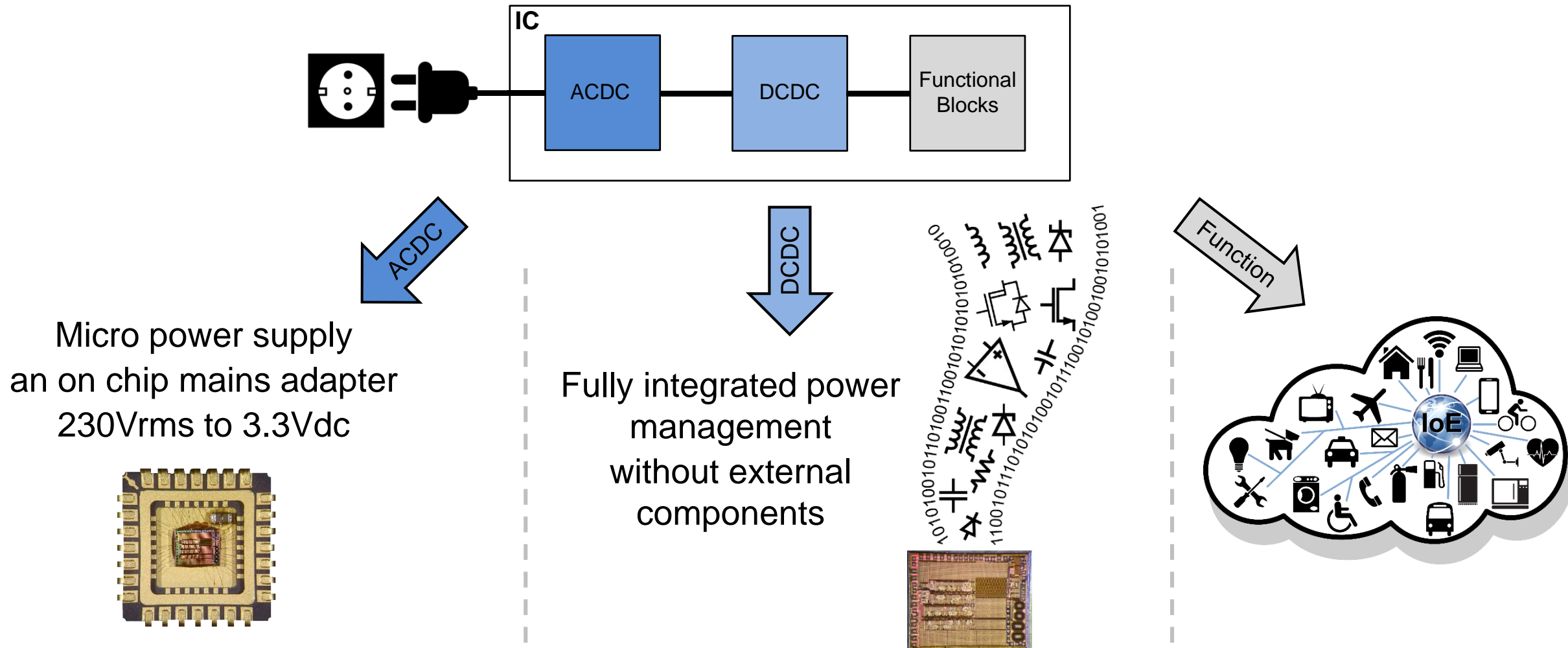


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Grand No. 03FH02713

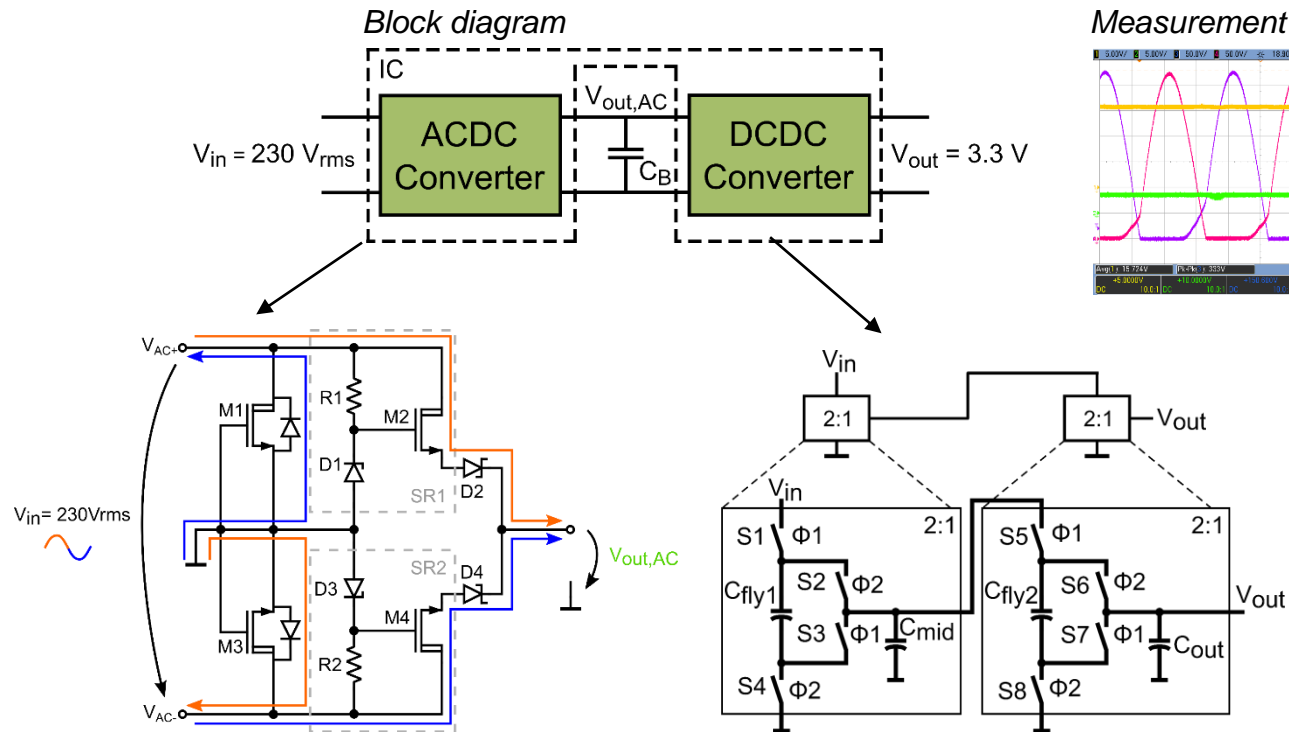


Fully Integrated Power Supply



A 120/230 Vrms-to-3.3 V Micro Power Supply

Highlights Fully integrated ACDC and DCDC converter with 3mW output power and one external SMD cap



Publications IEEE ESSCIRC 2016

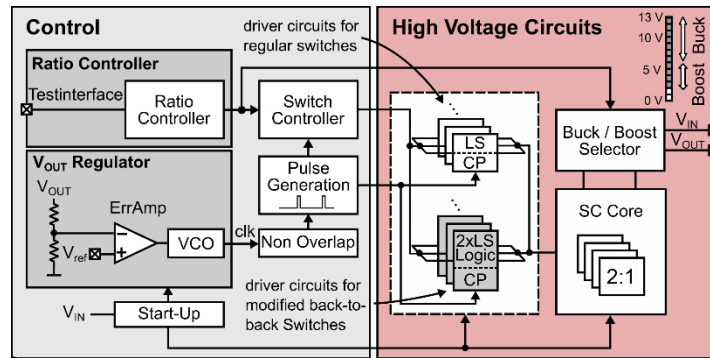
Goal Micro Power Supply as low power (~10mW) on-chip mains adapter

→ elimination of bulky power supplies, alternative to energy harvesting

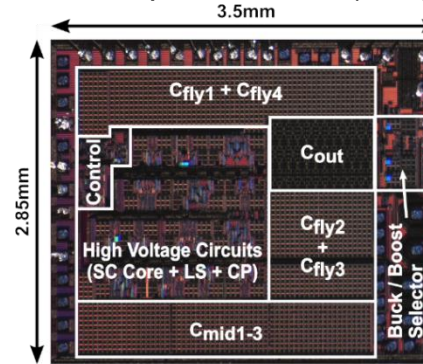
Fully Integrated 2-to-13V-Input SC Converter

Highlights World's first fully integrated capacitive DCDC converter with 13V input, buck-boost mode, novel area efficient back-to-back switch, $\eta_{max} > 80\%$

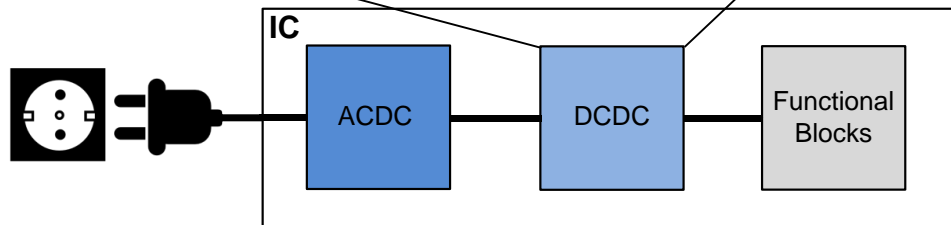
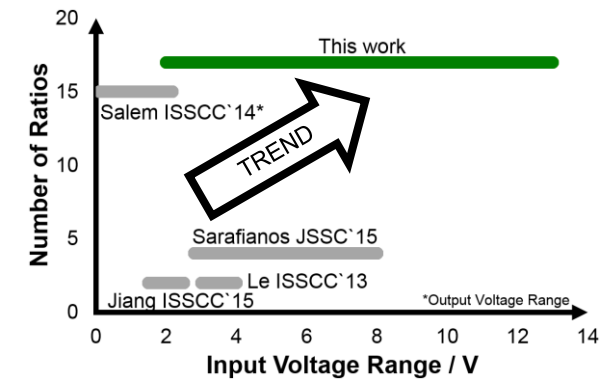
Block diagram



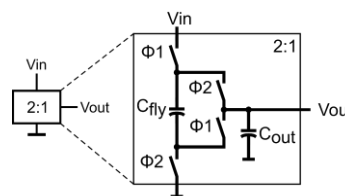
Test chip with 3.64nF (MIM)



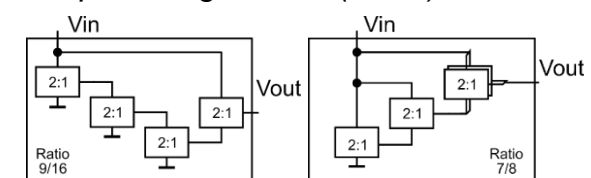
State of the art



Core SC cell



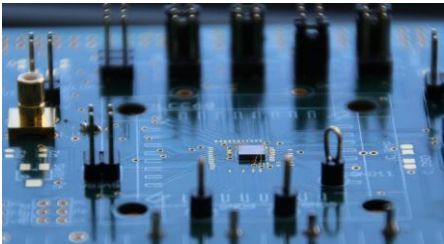
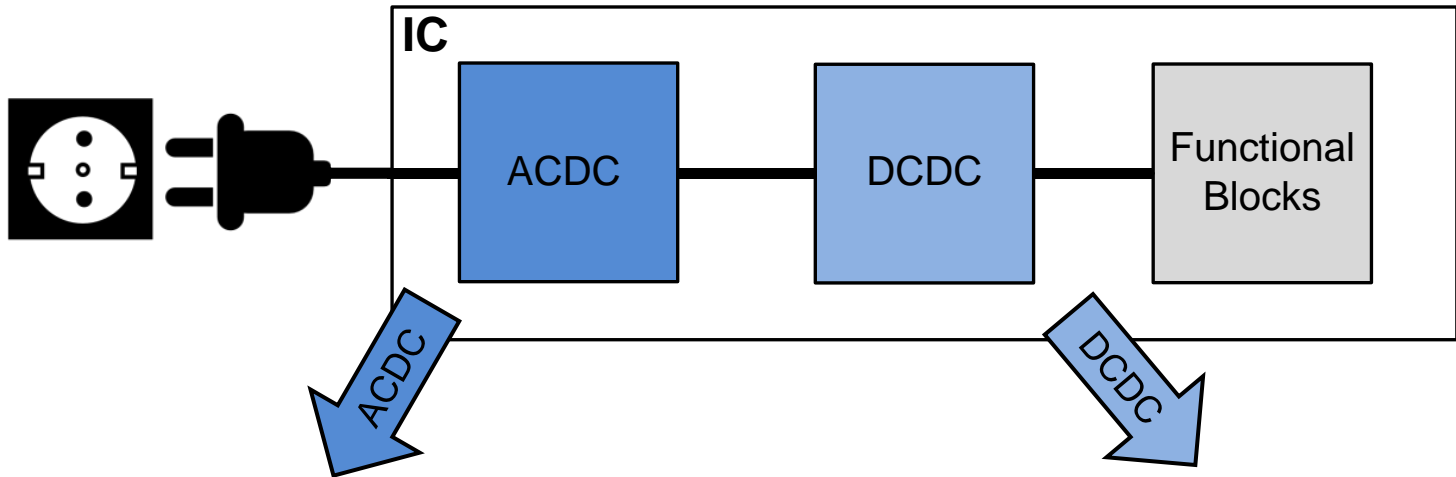
Example configurations (ratios)



Goal Part of ACDC converter as low power ($\sim 10\text{mW}$) on-chip mains adapter \rightarrow elimination of bulky power supplies, alternative to energy harvesting

Publications IEEE ISSCC 2016

High Vin SC Converters



Performance Comparison

	Tamez ESSCIRC'14	Meyvaert ESSCIRC'2012	This work
Technology	0.13 μm	0.35 μm	0.35 μm
V _{in}	120 Vrms	120/230 Vrms	120/230 Vrms
V _{out}	4 V	3.3 V	3.3 V
ext. components	-	1x SMD cap	1x SMD cap
Chip Size	3.5 mm ²	6 mm ²	7.7 mm ²
P _{out,max}	1.5 μW	208 μW	3 mW
Power Density	0.43 μW/mm ²	34.6 μW/mm ²	390 μW/mm ²

Performance Comparison

	Salem ISSCC'14	Sarafianos JSSC'15	Le ISSCC'13	Jiang ISSCC'15	This Work
Technology	0.25μm CMOS	90nm CMOS	65nm CMOS	65nm CMOS	0.35μm HVCMOS
Conversion ratios	15 (4bit)	1/2, 1/3, 1/4 1/5	1/3, 2/5	1/3, 1/4	8 buck + 9 boost
Efficiency (peak)	85%	76.6%	74.3%	79.5%	81.5%
Input voltage	2.5V	2.8-8V	3-4V	1.5-2.5V	2-13V
Output voltage	0.1-2.18V	1.2V	1V	0.4-0.7V	5V
Buck-boost mode	no	no	no	no	yes
Output power	4.6mW	50mW	121mW*	26mW	10mW (buck)
Total cap amount	3nF	5nF	3.88nF	not reported	3.64nF
Active area / mm ²	4.645	not reported	0.64	0.23	6.8

*calculated

Prototype of Proposed Micro Power Supply

